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NEOCENE MOLLUSCA OF TEXAS,
OR
FOSSILS FROM THE DEEP WELL AT GALVESTON

BY

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NEOCENE MOLLUSCA OF TEXAS,
Or,
Fossils from the Deep Well at Galveston.*

By
Gilbert D. Harris.

In a recent article by the present writer, published in the Philadelphia Academy's Proceedings, reference is made to a monograph on the Tertiary Mollusca of Texas, which, owing to the lack of funds at the disposal of the State Geological Survey, had remained for some time unpublished.

That the reader may have a clear idea as to what part of that monograph the Academy published and what part we purpose to bring out in this Bulletin, a summary of its contents is here given just as it was when completed, December 23, 1893.

Monograph of the Marine Tertiary Mollusca of Texas.

By Gilbert Dennison Harris.

Preliminary Remarks, pp. 1 - 5.†

Part 1. *Brief review of the literature on the Tertiary mollusca of Texas*, pp. 6 - 21.

Part 2. *Eocene mollusca of Texas*, pp. 22 - 352. — The name, author, synonymy, original description, additional remarks, all known localities for each species in Texas, important localities in other States, geological range, and where the type specimen may now be found.

Addenda to Part 2. *New or interesting Eocene mollusca from other States*, pp. 353 - 357,

Part 3. *Neocene mollusca of Texas, or Fossils from the Galveston deep well*, pp. 358 - 397. — The name, etc. as in Pt. 2, and the range in depth of each species.

Part 4. *Definition and correlation of the marine Tertiary deposits of Texas*, pp. 398 - 409. -- Section 1. Review of the works and opinions of earlier writers. Sec. 2.

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†Type-written pages, each equivalent to ¾ an 8vo printed page.

Conclusions drawn from the present paleontological study.

The last mentioned part is followed by (1) a detail account of all the localities or stations whence the Tertiary fossils were obtained, (2) a table showing at a glance the geographical distribution of the Eocene molluscan species in Texas and their geological range in this State and others farther east, (3) a table showing the bathymetric distribution of the Galveston well fossils, pp. 410-434, and (4) 36 large octavo plates illustrating the species mentioned or described in Parts 2 and 3.

The article published by the Academy contained the description of the new species of Part 2 and the figures belonging thereto; the majority of that part, and which alone is of present stratigraphic value, still remains in manuscript.

This Bulletin is practically a condensation of Part 3. It seems advisable that this unique material should no longer remain unpublished, for up to this date no other marine Neocene fossils are known from the Gulf slope west of Mississippi. The opinions expressed, regarding the age of the deposits penetrated, in the American Journal of Science, vol. 46, p. 42, and in the 4th Annual Report of the State Survey, 1893, are still maintained; in brief the section is as follows:—

Depth in feet.	*Geological horizon.*
46 to 458	Pleistocene.
548 to 1,510.	Doubtful.
1,510 to 2,158.	Upper Tertiary.
2,158 to 2,920	Miocene (Upper).

Specific Characterization.

PELECYPODA.

PECTEN.

Pecten sp.

Syn. *Pecten*, sp., 4th Ann. Rep. Tex. Surv., 1893, p. 121.

Characterization. – Subcircular in outline; right valve generally inflated about the umbonal region, with 16 or 17 smooth flat ribs equal in width to the interspaces; interspaces with more or less prominent concentric sculpturing ; ears, especially the anterior with radiating costæ more or less fimbriately sculptured ; space between the ears and the extreme lateral costæ on the side of the valve, smooth and moderately broad : left valve much less inflated ; with 17 or 18 slightly narrower and less flattened ribs with broader interspaces strongly marked by concentric striæ ; ears nearly equal, radially striate ; space between them and the extreme lateral ribs, smooth.

This species somewhat resembles *P. inæqualis* Sow., from West Indian Miocene deposits. That species, however, is smaller and more oblique. *P. dislocatus* Say is much less inequivalve and has two or three more costæ on each valve ; the spaces too, between the extreme anterior and posterior ribs and the ears are radiately striate or costate.

Range in depth. – From 2,236 to 2,920 feet.

MYTILUS.

Mytilus incrassatus.

Syn. *M. incrassatus* Con., Am. Jr. Sci., vol. 41, 1841, p.347.
" " Con., Foss. Med. Tert., 1845, p. 74, pl. 32, fig. 4.
Mytiloconcha incrassata Con., Pr. Ac. Nat. Sci. Phila., 1862, p. 291.

I am not aware that *Mytili* of this general type have appeared on the Atlantic or Gulf slope since late Miocene or early Pliocene times. Forms still living in the Pacific have ponderous shells with thickened hinge area, as for example *M. magellanicus*, but none agree quite so well with the Galveston species as *incrassatus* does.

Range in depth. – From 2,384 to 2,871 feet.

DREISSENSIA.

Dreissensia sp.

This form is very abundant, but generally badly eroded ; differs but little from specimens now living on the coast of Florida.

Range in depth. – From 2,123 to 2,873 feet.

ARCA.

Arca incongrua.

Syn. *A. incongrua* Say, Jr. Ac. Nat. Sci. Phila., vol. 2, 1822,

p. 268.
A. incongrua Reeve, Conch. Icon., vol. 2, pl. 8, fig. 50.

The Galveston specimens are small, but are well preserved and seem to admit of no doubt as to their identity with Say's species.

Range in depth. – From 2,443 to 2,920 feet.

Arca ponderosa var. *carolinensis.*

Syn. -- *Nœtia ponderosa* var. *carolinensis* Con., Proc. Phila. Ac. Nat. Sci., 1862, p. 290.
N. carolinensis Con., *ibid.*, p. 580.

The only differences observable between this variety as represented by specimens from the Natural Well, Duplin Co., N. C., and typical *ponderosa* seem to be that *carolinensis* is more nearly rectangular in outline and is more inequilateral. Conrad says, — "Compared to typical *ponderosa* it is less ventricose, proportionally longer, has 35 ribs whilst the latter has 26." I fail to find such a decided difference in the number of ribs in the two forms. They are very closely related. *Carolinensis* moreover has some features in common with *limula.*

Range in depth. – From 2,552 to 2,871 feet.

Arca transversa var. *busana*, n. var.

Syn. *Arca* young of *floridana?* Harris, 4th Ann. Rep. Geol. Surv. Tex., 1893, p. 121.

In my preliminary report on the organic remains from this well I queried the identity of this form with *floridana* though it agrees well with young specimens so labelled in the collection of the U. S. National Museum. It now seems quite certain that some of the Museum specimens are improperly labelled and that they should be regarded as specifically distinct from *floridana.* Following the advice of my friend, Mr. C. T. Simpson, I here refer the Galveston well specimens to a varietal form of *transversa*, for which the name *busana* is proposed. This variety may be defined as follows :—

General characteristics as in *transversa*, but much more elongated and less inflated ; hinge line not so extended as in *lienosa* or *floridana*, posterior broader, and base more nearly rectilinear, or even emarginate.

All the specimens from the well are young, the largest being but 12 mm. in length.

Range in depth .-- From the surface to 2,920 feet.

Arca labiata Sowerby, var. Pl. 1, fig's 1, 1a.

Syn. *A. labiata* Har., 4th Ann. Rep. Geol. Surv. Tex., 1893, p. 121.

Arca (small *Limopsis*-like) Har., *ibid.*; very young.

The specimens derived from the well at Galveston are generally small, though fragments of adults occur. The only difference between these Miocene specimens and those now living on the west coast of Mexico and Central America is that in the latter the ligamental area in either valve is broader and more nearly isosceles-triangular in outline. Accordingly the beaks in the well specimens are less distant and are twisted anteriorly. The correspondence of this variety with an undescribed form from the Pliocene of Alligator creek, Florida, is close. The well specimens are doubtless ancestral to both later forms and hence partake somewhat of the nature of both.

Range in depth. — From 2,510 to 2,871 feet.

LEDA.

Leda concentrica ? Say.

Syn. *L. concentrica* Har., 4th Ann. Rep. Geol. Surv., p. 121.

There is no question as to the identity of the two varietal forms included under this name with specimens collected from the Gulf shore and now included in the collection of the U. S. National Museum. There is some doubt in the mind of the writer as to whether all may properly be called *concentrica* Say.

Range in depth.— From the surface to 2,650 feet.

CRASSATELLA.

Crassatella gibbesi T. and H., var.

Syn. *C. gibbesi*, var., Har., 4th Ann. Rep. Tex. Surv., p. 121.

Dall's *C. floridana* is evidently a variety of this species. It differs from *gibbesi* in that (*a*) its posterior is less acute, (*b*) its anterio-dorsal margin is slightly concave while in *gibbesi* it is convex. For an excellent figure of *floridana* see Bull. U. S. National Museum No. 37, pl. 42, fig. 4.

The variety from the Galveston well is still further removed from *floridana*, its posterior being quite pointed. From *gibbesi* it seems to differ in having the two anterior cardinal teeth in the left valve less similar in size; the more medially located tooth is very small, and the lower border of the hinge plate curves slightly upwards at the point where the tooth approaches it. In typical *gibbesi* these two teeth are nearly equal and the lower border of the hinge plate is either straight or decurving where these teeth impinge upon it. That these varieties are not of specific importance becomes evident upon comparing specimens of Miocene, Pliocene, and recent age.

Range in depth. — From 2,158 to 2,920 feet.

ERIPYHLA.

Eriphyla galvestonensis, n. sp. Pl. 1, fig's 2, a, b.

Syn. *Eriphyla* sp. Har., 4th Ann. Rep. Geol. Surv., p. 121.

Specific characterization.— Form as indicated by the figures; hinge as in *E. lunulata*; exterior smooth, slightly undulating concentrically near the beaks; beaks, as in many species of *Astarte* and *Crassatella*, slightly flattened at the very apex but very gibbous just below.

Eriphyla lunulata is an exceedingly variable shell and is abundant in recent, Pliocene, and Miocene deposits on the Atlantic slope of the United States, but none in all the collection of the U. S. National Museum seem to correspond entirely in shape and much less in surface markings with this form.

Range in depth.— From 300 to 2,600 feet.

LUCINA.

Lucina crenulata.

Syn. *L. crenulata* Con., Foss. Sh. Med. Tert., 1840, p. 39, pl. 20, fig. 2.
L. crenulata Harris, 4th Ann. Rep. Geol. Surv., p. 121.

Range in depth.— From 2,410 to 2,871 feet.

Lucina dentata.

Syn. *L. dentata* Wood, Gen. Conch., p. 195, pl. 46, fig. 7, 1817.
L. dentata Harris, 4th Ann. &c., p. 121.

Range in depth.— From 2,387 to 2,871 feet.

Lucina floridana.

Syn. *L. floridana* Con., Am. Jr. Sci., 1833, vol. 23, p. 344.
L. floridana Har., 4th Ann. &c., p. 121.

Range in depth.— From 2,236 to 2,871 feet.

CARDIUM.

Cardium galvestonense, n. sp. Pl. 1, fig's 3, a.

Syn. *Cardium*, sp. nov., Har., 4th Ann. Rep., &c., p. 121.

Specific characterization.-- Form as indicated by the figures; surface marked by about 19 strong ribs, beautifully striated on their sides and in the interspaces with even, sharp concentric lines and bearing on their summits a row of strong pustules, except in the vicinity of the umbones.

This species is in many respects intermediate between *haitense* Sowerby and *antillarum* d'Orb. From the former it differs in having fewer ribs, in being not quite so oblique or elevated; from the latter it differs in having about one more rib, in having the ribs of more nearly equal size, in having a comparatively longer posterior margin, and in having a more nearly rectangular outline.

Range in depth.—From 2,443 to 2,871 feet.

Cardium sp., probably *magnum* Born.

Range in depth.—From 2,552 to 2,600 feet.

VENUS.

Venus, fragments, doubtless of some of the large varieties of *mercenaria* common in the upper Miocene, Pliocene and recent formations.

Range in depth.—From 2,236 to 2,600 feet.

CHIONE.

Chione ulocyma.

Syn. *Venus ulocyma* Dall, Coll. U. S. Nat. Mus., MS.
Chione, n. sp., Florida Miocene form, Harris, 4th Ann. Rep. Geol. Surv. Tex., p. 121.

So far as I am aware this species has never been described. It has somewhat the form of *C. cancellata* though rather more sharply triangular; the concentric lirations are rounded and close-set on the face of the valves but both anteriorly and posteriorly change in character and become irregularly lamelliform; numerous radiating lines pass over the rounded concentric rugæ; margin within finely and sharply crenulate.

This species was first collected by F. Burns from the upper fossiliferous bed at Alum Bluff, western Florida. It is therefore an upper or Yorktown Miocene form.

Range in depth.—From 2,236 to 2,650 feet.

Chione cancellata.

Syn. *Venus cancellata* Lin., Syst. Nat., 12th ed., 1767, vol. 1, p. 1,130.

Range in depth.—From 1,550 to 2,871 feet.

DONAX.

Donax carinata var. *galvestonensis.*

Syn. *D. carinata* Har., 4th Ann. &c., p. 121.

Inhabiting the western coast of Mexico and Central America is another form resembling somewhat closely *D. carinata* and mistaken for it by Reeve —Conch. Icon. vol. 8, pl. 2, fig. 11— but which in fact is quite distinct. It is devoid of the peculiar sharp carina bordering the posterior slope, has no granules on the radiating striæ of this slope, and is devoid of the broad radiating color bands.

The Galveston well specimens are not so sharply carinate as *carinata*, but have the granulated radii of that species. Variety *galvestonensis* is somewhat intermediate between these two living species.

Range in depth.—From 2,552 to 2,920 feet.

Donax tumida.

Syn. *D. tumida* Phil., Rœmer's Texas, 1849, p. 453.
D. tumida Har., 4th Ann. &c., p. 121.

Range in depth.— From the surface to 458 feet.

STRIGILLA.

Strigilla galvestonensis n. sp. Pl. 1, fig. 4.

Syn. *Strigilla* near *pisiformis* Har., 4th Ann. &c., p. 121.

Specific characterization.-- This small *Strigilla* is somewhat allied to *pisiformis* Lin., but is less inflated especially about the umbones, is fuller on the anterior submargin, and its beaks are slightly inclined to point backwards instead of forwards.

Range in depth.— From 2,552 to 2,733 feet.

ABRA.

Abra æqualis.

Syn. *Amphidesma æqualis* Say, Jr. Phila. Ac. Nat. Sci., 1822, p. 307.
Syndosmya æqualis Har., 4th Ann. &c., p. 121.

Range in depth.-- From the surface to 900 feet.

RANGIA.

Rangia cuneata var. *galvestonensis*, nov. var. Pl. 2, fig's 1, a, b.

Syn. *Gnathodon* (nearest *cuneatus*) Har., 4th Ann., p. 121.

Variety *galvestonensis* differs from the typical form by having a less angular outline, by being less carinated from the umbones to the posterior termination, and by having the beaks less distant. Some specimens, however, are very close to *cuneatus*; the teeth in all are the same.

Range in depth.— From 1,510 to 2,920 feet.

Rangia? quadricentennialis, n. sp. Pl. 2, fig's 2, a, b, c.

Syn. *Gnathodon*, n. sp., Har., 4th Ann., &c., 1893, p. 121.
Spisula? quadricentennialis Dall, Proc. U. S Nat. Mus. vol. 17, 1894, p. 105.

Specific characterization.— Shell elliptical in outline as figured; thin; surface nearly smooth, except on the broadly rounded umbonal ridge the concentric striæ are more or less prominent in old specimens; a faint, broad sinus extends from beak to base; teeth of the right valve shown in fig. 2 a, those of the left in 2 c. Fig. 2 b represents the shell as it usually appears, the hinge plate being nearly always broken away.

Range in depth.— From 2,100 to 2,249 feet.

Type.— Texas State Museum.

MACTRA.

Mactra lateralis.

Syn. *M. lateralis* Say, Jr. Ac. Nat. Sci. Phila., vol. 2, 1822, p. 309.
M. lateralis Har., 4th Ann. &c., p. 121.

Range in depth.— From 300 to 2,920 feet.

Mactra quadricentennialis, n. sp. Pl. 2, fig's 3, a, b.

Syn. *Mactra*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization.— General form cuneate as figured; hinge as shown in fig's 3, 3b; substance of the shell either thin and showing but slight traces of muscular scars within, or slightly thickened and showing the muscular scars and a small pallial sinus. A ridge extends from the umbones to the posterior margin; a less marked though observable ridge extends from the umbones to the anterior margin.

Range in depth.— From 2,236 to 2,871 feet.

LABIOSA.

Labiosa canaliculata.

Syn. *Lutraria canaliculata* Say, Jr. Ac. Nat. Sci. Phila., vol. 2, 1822, p. 311.
Labiosa canaliculata Har., 4th Ann. &c., p. 121.

Range in depth.—From 46 to 2,871 feet.

CORBULA.

Corbula galvestonensis, n. sp. Pl. 2, fig's 4, a.

Specific characterization.—This little round *Corbula* belongs to the same section as *disparilis* d'Orb. and *krebsiana* C. B. Ad., but differs from the latter in being less produced posteriorly, and from the former in the lack of an umbonal carination. The last mentioned feature gives *disparilis* a biangulate posterior margin while the corresponding margin of this species is strongly arcuate.

Range in depth.—From 2,443 to 2,650 feet.

Corbula (*Potamomya*) *priscopsis*, n. sp. Pl. 2. fig's 5, a.

Specific characterization.—General form as indicated by the figures; apex acute; a ridge traversing the umbonal slope radially; a monoclinal ridge (sloping posteriorly) extending from beak to anterio-basal margin; hinge teeth characteristic of this sub-genus.

Unfortunately but one specimen of this peculiar form was obtained. It resembles *prisca* Mart. from southern Brazil.

Range in depth.—From 2,443 to 2,448 feet.

Corbula swiftiana? Pl. 2, fig. 6.

Syn. *C. swiftiana* Ad., Cont. to Conch., 1852, p. 236.
Corbula, sp. undt., Har., 4th Ann. &c., p. 121

There are several recent so-called species inhabiting the southeast coast of the United States and the West Indian shores, and others the western coast of South and Central America that can scarcely be distinguished from this species when large numbers of specimens are brought together. *Swiftiana* of the West Indies is unhesitatingly referred by Arango (Faun. Mal. Cub., 1878, p. 253) to *nasuta* Sby. from the west coast of U. S. Columbia. Dall however in Bull. 37, U. S. Nat. Mus., 1889, p. 70 restores *swiftiana* to specific rank, also admits the presence of *nasuta* on our eastern coast. The Texan forms resemble most nearly immature specimens of *swiftiana* as understood by Dall in the work just cited, pl. 2 fig. 5a, though some specimens have an outline closely approximating pl. 1, fig. 6. On page 70 of the same work the latter is styled *contracta* Say while in Bull. Mus. Comp. Zool., vol. 12, p. 314 it is called *kjoeriana* Ad. Finally, these Texan well specimens do not differ widely from *nasuta* Con., from the Claiborne sands; they all belong to the same section of the genus.

Conrad's *nasuta* must give place to Lea's *alabamiensis*. It may also be observed here that Hinds' name *cuneata*, 1843, must be replaced by another for Say described a *C. cuneata* in 1824.

Range in depth.-- From 300? to 2,920 feet.

PHOLAS.

Pholas costata.

Syn. *P. costata* Linn., Syst. Nat., 10th ed., 1758, p. 669.

A careful description and fine figure of this species will be found on pp. 36 and 37 of Gould's report on the Invertebrata of Massachusetts, 2nd ed., 1870. See also Bull. U. S. Nat. Mus., No. 37, pl. 68, fig. 9.

Range in depth.— From 2,410 to 2,476 feet.

SCAPHOPODA.

DENTALIUM.

Dentalium tetragonum.

Syn. *D. tetragonum* Sby., Thes. Conchyl., 1860, p. 103.
D. tetragonum var. Har., 4th Ann. &c., p. 121.

Range in depth. – From 2,158 to 2,920 feet.

Dentalium quadrangulare?

Syn. *D. quadrangulare?* Har., 4th Ann. Rep., p. 121.

This species is figured in Thes. Conchyl., pl. 2, fig. 31. It is quite evident that the figure represents a young individual. The Texan specimens whether of this species or not may be characterized thus: Moderately tapering; smooth and square at the minor aperture, the angles slightly intensified by a heavy raised line on each; thick; below, four more angulations appear making the shell octagonal; still lower the interspaces are surcharged with ribs or striæ so that at base the shell shows 16, 32 or even 64 ribs.

Range in depth. – From 2,465 to 2,871 feet.

GASTROPODA.

ACTAEON.

Actæon galvestonensis, n. sp. Pl. 3, fig. 1.

Syn. *Actæon* nearest *punctostriatus*, Har., 4th Ann., &c., p. 121.

Specific characterization.—General form as indicated by the figure; whorls about 5, the upper nearly or quite smooth, below however there is a subsutural spiral line while the greater part or all of the body whorl is covered by spiral striæ showing a tendency to alternate in size; columellar fold strong; substance of the shell moderately thick.

This species has much in common with *lineatus* Lea of the Claiborne sand, but is more nearly related to *punctostriatus* Ad., from which it differs in thickness, position and size of columellar fold, and height. *A. cubensis* is striated somewhat like this but it is much shorter.

Range in depth. — From 2,552 to 2,871 feet.

Type.—Texas State Museum.

TORNATINA.

Tornatina bullata.

Syn. *Tornatella bullata* Keiner, Spec. Gen., p. 5, pl. 1, fig. 4. *Fide* Moerch.
Cylichna sp. Har., 4th Ann. Rep., p. 121.

Range in depth.— From 2,410 to 2,425 feet.

Sub-genus *Cylichnella.*

Cylichnella bidentata var. *galvestonensis*, n. var. Pl. 3, fig. 2.

For a good figure of this species see Bull. U. S. Nat. Mus., No. 37, pl. 41, fig. 14. The Texan specimens are slightly more globose, with a tendency to increase in size upwards instead of downwards; moreover its columellar plications are stronger than those of *bidentata.*

Range in depth.—From 2,600 to 2,733.

VOLVULA.

Volvula sp.

Syn. *Volvula* close to *cylindrica*, Har., 4th Ann. &c., p. 121.

This is a long slender form with a thin shell faintly striated spirally at base. It differs from *oxytata* Bush from our eastern coast by its greater length, narrower form, and thinner shell. It may be only a variety of *cylindrica* Gabb, a West Indian Miocene form even longer than this, but Gabb's name is preoccupied by Carpenter's *cylindrica* from the western coast.

Range in depth. —From 2,552 to 2,650 feet.

TEREBRA.

Terebra concava.

Syn. *Turritella concava* Say, Jr. Phila. Ac. Nat Sci., vol. v, 1826, p. 207.
Terebra concava Har., 4th Ann. Rep. p. 121.

Range in depth.— From 2,552 to 2,920 feet.

Terebra dislocata . Pl. 3, fig. 3.

Syn. *Cerithium dislocatum* Say, Jr. Phila. Ac. Nat. Sci., vol. 2, 1822, p. 235.

Range in depth. – From 2,158 to 2,920 feet.

Terebra langdoni. Pl. 3, fig. 4.

Syn. *Terebra langdoni* Dall, Proc. U. S. N. M., v. 18, p. 45.
Terebra, Chipola form, Harris, 4th Ann. Rep.. p. 121.

Dall's description.— Shell small, slender, of 13 whorls besides the nucleus which is small, conical and of three whorls ; sculpture reticulated transversely by 16 low, narrow, rounded, slightly flexuous ribs with wider interspaces, the posterior ends of the ribs not cut off by the deep sulcus which defines the sutural band in front ; transverse sculpture of this sulcus visible between the ribs and four flattish spirals, separated by narrow grooves, between the sulcus and the next suture, and seven or eight narrow spirals on the base ; aperture longer than wide ; pillar simple, smooth, canal rather long, twisted and recurved. Length 20, maximum diameter 4 mm.

As a rule the Texan forms are somewhat stouter than those from Florida and the number of plicæ is about eighteen.

Type of the species.—U. S. Nat. Museum.

Specimen figured.—Texas State Museum.

Range in depth. – From 2,158 to 2,920 feet.

Terebra galvestonensis, n. sp. Pl. 3, fig. 5.

Syn. *Terebra*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization.— General form as indicated by the figure; apical 3 whorls smooth, remaining 9 or 10 marked as follows: Each whorl with (*a*) about 12 longitudinal costæ, narrower than the interspaces, (*b*) a deeply incised line about one-third way from upper to lower suture, (*c*) a faint spiral line near the base of each whorl; (*d*) several spiral lines on the basal portion of the body whorl. The spiral line referred to under (*c*) seems to vanish on the penultimate whorl after passing the longitude of the upper margin of the aperture. Two spiral lines, *i. e.*, the one corresponding with the suture and the one just below, are here and elsewhere on the body whorl particularly prominent. The columellar fold is plainly biplicate. As in the preceding species the plicæ on the different whorls are generally in line, but in contradistinction to that species the lines in this swing to the right or backwards in passing from apex to base.

Range in depth. – From 2,387 to 2,871 feet.

CONUS.

Conus puncticulatus. Pl. 3, fig. 6.

Syn. *C. puncticulatus* Hwass, Enc. Meth.- *Fide* Reeve.

There are several so-called species of *Conus* on either side of the Isthmus of Panama that are closely allied to this. The good specimens are nearly always immature; they are generally more strongly grooved at base than typical *puncticulatus* is, hence they resemble closely *pygmæus*; but the general form, crenulations and fragments of adult shells indicate a closer relationship with the former.

Range in depth.— From 2,236 to 2,920 feet.

PLEUROTOMA.

Pleurotoma albida.

Syn. *P. albida* Perry, Conchology, 1811, expl. of Pl. 32, fig. 4.
P. albida Harris, 4th Ann. &c., p. 121.
See Trans. Wag. Fr. Inst. Sci., vol. 3, 1890, p. 28.

Range in depth.— From 2,158 to 2,920 feet.

Pleurotoma (*Drillia*) *quadricentennialis*, n. sp. Pl. 3, fig. 7.

Syn. *Pleurotoma*, n. sp., Har., 4th Ann. Rep., p. 121.

Specific characterization. -- General form as indicated by the figure; whorls 8; 1 and 2 smooth; 3 longitudinally costate; the remaining whorls seven-costate, the costæ on the different whorls being arranged in line; slit very close to the suture; body whorl with numerous faint spiral lines; beak long and but slightly deflected.

Range in depth.— From 2,717 to 2,733 feet.

Pleurotoma (*Cithara*) *galvestonensis*, n. sp. Pl. 3, fig. 8.

Syn. *Cithara*, n. sp., Har., 4th Ann. Rep., &c., p. 121.

Specific characterization.-- General form as indicated by the figure; whorls 6 or 7; 1 and 2 smooth, very small; remaining whorls increasing in size rapidly, 7 - 10 costate, with incised lines noticeable especially on the body whorl; spiral lines most pronounced on the summits of the ribs and on the middle and lower part of the body whorl; every fourth or fifth line often noticeably deep; aperture about two-thirds the length of the whole shell; labrum thickened both without and within. A tooth-like projection is often present in old specimens on the labrum not far from the upper termination of the aperture.

Range in depth.—From 2,236 to 2,871 feet.

CANCELLARIA.

Cancellaria clavatula. Pl. 3 fig. 9.

Syn. *C. clavatula* Sby, Proc. Zool. Soc. Lond., 1832, p. 52.
C. clavatula Har., 4th Ann. &c., p. 121.

Range in depth.—From 2,552 to 2,600 feet.

Cancellaria reticulata Lin., var. Pl. 3, fig. 10.

Syn. *C. reticulata*, var., Har., 4th Ann. &c., p. 121.

The well specimens are comparatively small and are doubtless young. *Reticulata* proper is apt to have a more noticeable subsutural shoulder on the whorls than is shown on any of these specimens.

Range in depth.—From 2,158 to 2,920 feet.

Cancellaria galvestonensis, n. sp. Pl. 3, fig. 11.

Syn. *Cancellaria*, n. sp., Harris, 4th. Ann. Rep. Geol. Surv. p. 120.

Specific characterization.-- Size and general form as indicated by the figure; whorls about 5; blunt at apex; spire as a whole slightly convex; longitudinal lirations varying considerably in strength, all comparatively weak; spiral striation even, plainly visible though not deep; aperture lirate within; columella long, nearly straight, with two supra-medial strong plications; umbilicus comparatively well developed.

Range in depth.-- From 2,552 to 2,600 feet.

OLIVA.

Oliva reticularis Pl. 3, fig. 12.

Syn. *O. reticularis* Lam., Ann. du Mus., vol. 16, 1810, p. 314.

Oliva literata Har., 4th Ann. &c., p. 121.

O. literata and *reticularis* are certainly very closely allied, and without the aid of the color markings their discrimination is difficult. The well specimens are referred to the latter species on account of their short spire and broad short form. See Reeve's figures.

Range in depth.—From 2,158 to 2,920 feet.

OLIVELLA.

Olivella galvestonensis, n. sp. Pl. 3, fig. 13.

Syn. *Olivella*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization. -- General form as indicated by the figure; whorls about 5, smooth; suture deep and prominent, well calloused as it approaches the aperture; outer lip rather thin on the margin, with numerous lirations within; inner lip with a callosity which extends to the suture of the penultimate whorl, and upon this callosity a second extending from the base upwards two thirds the length of the columella; columella dentato-lirate, at base with a strong fold which follows up the axis of the shell to the apex, as seen in broken specimens.

Range in depth.-- From 2,410 to 2,871 feet.

Olivella subtexana, n. sp. Pl. 4, fig. 1.

Syn. *Olivella*, n. sp., Har., 4th Ann., &c., p. 121.

Specific characterization.—General form as indicated by the figure; whorls 6; columella well marked; a callosity extending upwards from the suture of the body whorl half way to that of the penultimate whorl; outer lip non-lirate within; inner lip with plications on the lower two thirds of its length, strong above and below but smaller medially.

Range in depth.—From 2,552 to 2,871 feet.

MELONGENA.

Melongena melongena.

Syn. *Murex melongena* Linn., Syst. Nat., 10th ed. 1758, p. 751.

Melongena melongena of various authors.

Range in depth.—From 2,448 to 2,465 feet.

NASSA.

Nassa galvestonensis, n. sp. Pl. 4, fig. 2.

Syn. *Nassa*, n. sp. near *ambigua*, Harris, 4th Ann. &c.

Specific characterization.— General form as indicated by the figure; whorls 6 or 7; 1, 2, and sometimes 3 smooth; below longitudinally, obliquely plicate and strongly spirally striate, the striations slightly enlarged on the plicæ; the latter on the body whorl from 10 to 13 in number, slightly smaller for some distance behind the thickened lip, all crossed by a more or less strongly marked subsutural line or depression; labrum thin at the margin but thickening rapidly without by a strong varix, striate within; labium well calloused, a spiral line or ridge above, extending to a sharp point below, canal extremely short.

Range in depth.—From 2,410 to 2,871 feet.

Nassa trivigalvesta, n. sp. Pl. 4, fig. 3.

Syn. *Nassa*, allied to *trivittata*, Har., 4th Ann. &c., p. 121.

Specific characterization. -- General form as indicated by the figure; whorls 7; 1 and 2 smooth, small; remaining whorls sculptured somewhat as in *trivittata* Say but appearing less coarse and granular, approaching *peralta* Con.; labrum rather finely lirate within; labium generally with no trace of a fold or line above.

Range in depth.— From 2,158 to 2,871 feet.

Nassa acuta.

Syn. *N. acuta* Say, Jr. Phil. Ac. Nat. Sci., vol. 2, 1822, p. 234.
N. acuta Har., 4th Ann. Rep., p. 121.

Range in depth.—From 440 to 2,871 feet.

PHOS.

Phos galvestonensis, n. sp. Pl. 4, fig's 4,5.

Syn. *Phos*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization.-- General form as indicated by the figures; whorls 8; 1, 2, 3 smooth, very rotund; remaining whorls provided with rather narrow longitudinal ribs, crossed by even, rather strong spiral lines which increase slightly in size as they pass over the ribs; whorls slightly shouldered below the suture, and on the humeral zone there is one comparatively fine spiral line; one or two spiral lines of secondary order appear between the stronger ones on the middle of the body whorl; labrum well lirated within; labium sometimes with oblique, rather fine, raised striæ or plications; canal long, slightly twisted.

Range in depth.—From 2,158 to 2,871 feet.

Type of the species.—Texas State Museum.

COLUMBELLA.

Sub-genus Anachis.

Anachis obesa.

Syn. *Buccinum obesum* C. B. Ad., Proc. Bost. Soc. Nat. Hist., vol. 2, 1845, p. 2.
Columbella obesa C. B. Ad., Cont. to Conch., 1850, p. 55.
Anachis obesa Dall, Bull. Mus. Com. Zool., 18, pt. 2, 1889, p. 188.
Anachis obesa Har., 4th Ann. &c., p. 121.

Range in depth.—From 440 to 456 feet.

Sub-genus Strombina.

Strombina gibberula Sby, var. *galvestonensis*, n. var. Pl. 4, fig. 6.

Syn. *Strombina gibberula* Har., 4th Ann. &c., p. 121.

Variety *galvestonensis* differs from the typical specimens from the western coast of Central America in having a stouter body whorl in proportion to the spire, and in having a spire that sometimes shows signs of plications, very rarely as strong as indicated in the figure.

Range in depth. – From 2,410 to 2,871 feet.

SCALA.

Scala galvestonensis, n. sp. Pl. 4, fig. 7.

Syn. *Scala*, n. sp., Har., 4th Ann. &c., p. 121.

Specific characterization.—General form as indicated by the figure; whorls about 9, all very rotund and with exceedingly fine costæ inclining strongly to the left as they pass up and over each whorl; body whorl with a strong spiral line, a projection of the sutural contact.

Range in depth.— From 2,552 to 2,871 feet.

EULIMA.

Fragments of specimens belonging to this genus are common at various depths.

PYRAMIDELLA.

The specimens found may be characterized thus: whorls 11, smooth; suture deeply channelled; body whorl with a revolving line projected from the suture; columella with one strong medial plait, below which are often two or more subordinate ones especially in large specimens.

Range in depth.— From 2,410 2,473 feet.

ODONTOSTOMIA.

Odontostomia conoidea.

Syn. *Turbo conoideus* Brocchi, Conch. Foss. Subap., 2, p.

659, pl. 16, fig. 2.-- *Fide* Jeffreys.
Odostomia conoidea Jeff., Brit. Conch., vol 4, 1857, p. 127.
Odontostomia conoidea Har., 4th Ann. &c., p. 121.

Range in depth.-- From 440 to 458 feet.

BITTIUM.

Bittium galvestonense, n. sp. Pl. 4, fig. 8.

Syn. *Bittium*, allied to *annettæ*, Har., 4th Ann. &c., p. 121.

Specific characterization.-- General form as indicated by the figure; whorls about 7 ; apical 2 or 3 smooth ; below, strongly and regularly sculptured as follows : On each whorl four equal spiral lines, crossed by rather fine longitudinal ribs of about the size of the spiral lines ; labrum thin, but close behind it, a strong varix .

This varix is occasionally found as far as one half whorl back of the mouth, but this is exceptional. Several varices are sometimes found on various portions of the spire. They often bend or change the axis of the shell and invariably obliterate the longitudinal sculpturing in their immediate vicinity.

This species resembles *annettæ* Dall somewhat but is at once distinguished by the number and equality of the spiral lines.

Range in depth.— From 2,550 to 2,871 feet.

Type.-- Texas State Museum.

CERITHIUM.

Cerithium galvestonense, n. sp. Pl. 4, fig's. 9,a.

Specific characterization.-- General form as shown by the figures ; whorls about 10 ; 1 smooth, remaining spiral whorls marked by numerous broad and rather obtuse longitudinal ribs crossed by spiral lines of varying size, finer above the supra-medial slight carination, coarser below, and at base strongly crenulate ; body whorl with a strong varix ; canal slightly bent to the left.

In old specimens the ribs, of the body whorl in particular, often project at the shoulder, forming blunt spines. In such cases the fine spiral striation of the humeral slope continues downward to the first crenulated line. There are in some instances two varices on the body whorl and occasionally they occur on the spiral volutions. Rarely all spiral lines are more or less granular.

Range in depth. – From 2,236 to 2,920 feet.

Type.--Texas State Museum.

Cerithium sp. α. Pl. 4, fig's 10,a.

Fragments distinguished from the preceding species by their more slender form, finer ribs, alternate and even striation, and lack of granulation. It will be observed also that in this species the ribs are prominent only above the middle of each whorl.

Range in depth.– From 2,236 to 2,871 feet.

Cerithium sp. β. Pl. 4, fig. 11.

Fragments resembling *galvestonense* in size and number of ribs but without a carination and granulations; basal stria of each whorl noticeably larger than the others.

Range in depth. -- From 2,236 to 2,920 feet.

Cerithium sp. γ. Pl. 4, fig. 12.

Fragments distinguished from the above by the gentle sloping humerel band, the non-alternate spiral striation, and the large spiral line just below the suture.

Range in depth. -- From 2,465 to 2,871 feet.

MODULUS.

Modulus modulus? Lin.

Small, imperfect specimens from depths of 2,552 and 2,871 feet.

TURRITELLA.

Turritella subgrundifera Dall, var.

The variety from the well inclines somewhat towards *tigrina* Kiener, now living on the western coast of Mexico, for the basal carina is not quite so prominent and the spiral striæ not so limited in number nor so even in size as in the typical form. Again, fragments indicate that this variety sometimes attains a considerably larger size than the type form.

Range in depth.— From 2,552 to 2,920 feet.

SOLARIUM.

Solarium granulatum.

Syn. *S. granulatum* Lam., An. sans Vert., vol. 7, p. 3.
" " Har., 4th Ann. Rep., p. 121.

Range in depth. – From 2,158 to 2,871 feet.

CRUCIBULUM.

Crucibulum near *auriculum* Gm.

Badly worn, small specimens.
Range in depth.– From 2,236 to 2,920 feet.

CREPIDULA.

Crepidula close to *convexa* Say.

All specimens immature.
Range in depth. —From 2,552 to 2,871 feet.

NATICA.

Natica canrena.

Syn. *N. canrena* Lam., An. sans Vert., vol. 6, 1822, p. 199.
" " Harris, 4th Ann. Rep.. p. 121.

Range in depth.— From 2,158 to 2,920 feet.

Natica duplicata.

Syn. *N. duplicata* Say, Jr. Phila. Ac. Nat. Sci., vol. 2, 1822, p. 247.
N. duplicata Har., 4th Ann. Rep. p. 121.

Range in depth.— From 2,158 to 2,920 feet.

Natica (*Lunatia*) *eminuloides.* Pl. 4, fig. 13.

Syn. *L. eminuloides* Gabb, Jr. Phila. Ac. Nat. Sci., vol. 8, 1878, p. 339, pl. 44, fig. 4.
L. eminuloides Har., 4th Ann. &c., p. 121.

Range in depth.— From 2,465 to 2,733 feet.

SIGARETUS.

Sigaretus perspectivus.

Syn. *S. perspectivus* Say, Amer. Conch., iii, 1831.

S. perspectivus Har., 4th Ann., &c., 1893, p. 121.

Range in depth.— From 2,552 to 2,600 feet.

NERITINA.

Neritina sp.

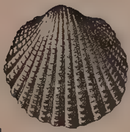
Small, eroded specimens ranging from 2,600 feet to 2,650 feet.

* * *

EXPLANATION OF PLATE I.

(**7**)

Fig. 1, a. *Arca labiata* Sby., var.................................. Page
.... (very young) longitude 7 mm.................. 7, **89**.
2, a, b. *Eriphyla galvestonensis*, n. sp. ; long. 4 mm... 8, **90**.
3, a. *Cardium galvestonense*, n. sp. ; long. 5.5 mm.... 9, **91**.
4. *Strigilla galvestonensis*, n. sp. ; long. 5 mm.........10, **92**.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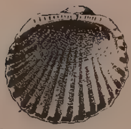
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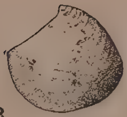
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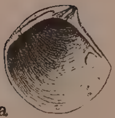
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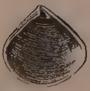
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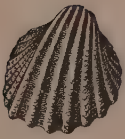
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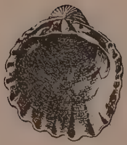
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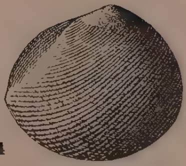
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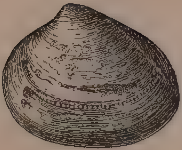
EXPLANATION OF PLATE 2.

(**8**)

Fig.		Page.
1, a, b.	*Rangia cuneatus*, var. *galvestonensis*, nov. var.; long. 16 mm	11, **93**.
2, a, b, c.	*Rangia quadricentennialis*, n. sp.; long. 13 mm	11, **93**.
3, a, b.	*Mactra quadricentennialis*, n. sp.; long. 9 mm	11, **93**.
4, a.	*Corbula galvestonensis*, n. sp.; long. 5.5 mm	12, **94**.
5, a.	*Corbula* (*Potamomya*) *priscopsis*, n. sp.; long. 13 mm	12, **94**.
6.	*Corbula swiftiana?* Adm.; long. 15 mm	12, **94**.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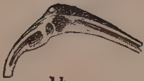
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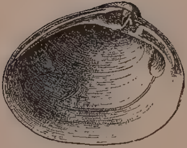
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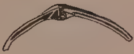
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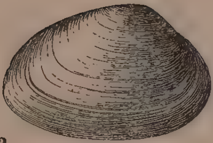
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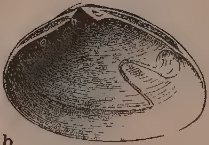
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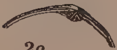
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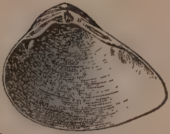
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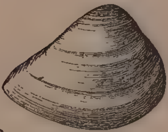
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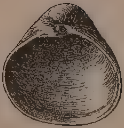
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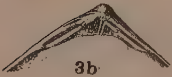
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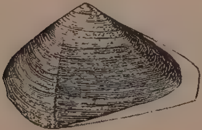
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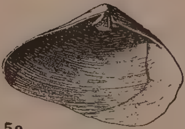
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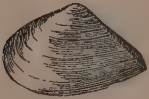
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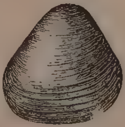
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EXPLANATION OF PLATE 3

(9)

Page.

Fig. 1. *Actæon galvestonensis*, n. sp. ; long. 5 mm.......... 14, **96**.

2. *Cylichnella bidentata* var. *galvestonensis*, n. sp. ;...... .... long. 5 mm.. 14, **96**.

3. *Terebra dislocata* Say, ; long. 24 mm..................15, **67**.

4. *Terebra langdoni* Dall ; long. 21 mm..................15, **67**.

5. *Terebra galvestonensis*, n. sp. ; long. 14 mm........ 16, **98**.

6. *Conus puncticulatus* Hwass, young, var. ; ....long. 20 mm.. 16, **98**.

7. *Pleurotoma* (*Drillia*) *quadricentennialis*, n. sp. ; .... long. 15 mm....................................17, **99**.

8. *Pl.* (*Cithara*) *galvestonensis*, n. sp. ; long. 10 mm.17, **99**.

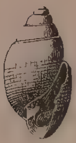
9. *Cancellaria clavatula* Sby. ; long. 13.5 mm......... 17, **99**.

10. *Cancellaria reticulata* Lin. (young); long. 16 mm. 17, **99**.

11. *Cancellaria galvestonensis*, n. sp. ; long. 15 mm... 18, **100**.

12. *Oliva reticularis* Lam. ; long. 22 mm............... 18, **100**.

13. *Olivella galvestonensis*, n. sp. ; long. 12 mm...... 18, **100**.



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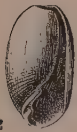

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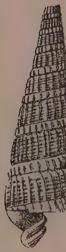

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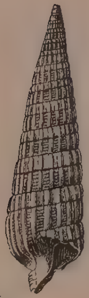

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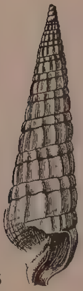

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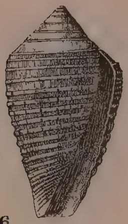

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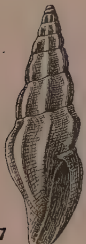

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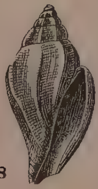

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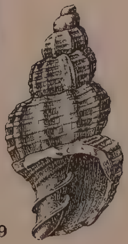

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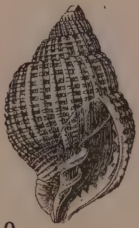

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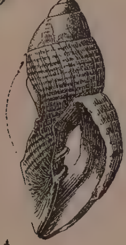

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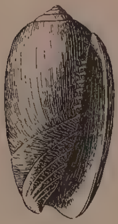

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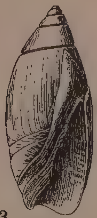
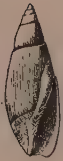


13

EXPLANATION OF PLATE 4.

(**10**)

		Page.
Fig. 1.	*Olivella subtexana*, n. sp. ; long. 10.5 mm	18, **100**.
2.	*Nassa galvestonensis*, n. sp. ; long. 7.5 mm	19, **101**.
3.	*Nassa trivigalvesta*, n. sp. ; long. 10 mm	19, **101**.
4.	*Phos galvestonensis*, n. sp. ; long. 13 mm	20, **102**.
5.	The same, larger specimen ; long. 20 mm.	
6.	*Strombina gibberula* var. *galvestonensis*, n. var. long. 10 mm	21, **103**.
7.	*Scala galvestonensis*, n. sp. ; long. 8 mm	21, **103**.
8.	*Bittium galvestonense*, n. sp. ; long. 5.5 mm	22, **104**.
9, a.	*Cerithium galvestonense*, n. sp. ; long. of 9, 18 mm of 9a, 9.5 mm	22, **104**.
10, a.	*Cerithium* sp. α ; long. of 10, 13 mm of 10a, 16 mm	23, **105**.
11.	*Cerithium* sp, β ; long. 12.5 mm	23, **105**.
12.	*Cerithium* sp. γ ; long. 14 mm	23, **105**.
13.	*Natica* (*Lunatia*) *eminuloides* Gabb ; long. 9 mm	24, **106**.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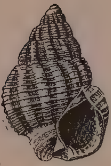
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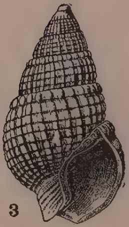
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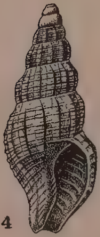
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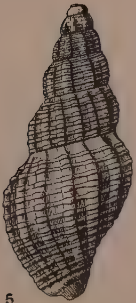
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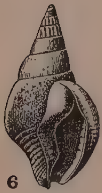
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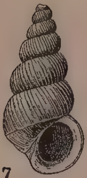
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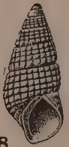
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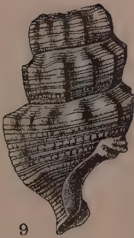
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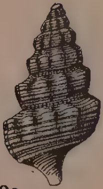
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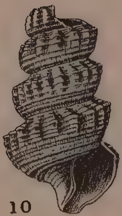
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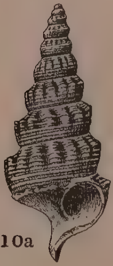
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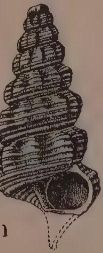
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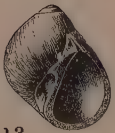
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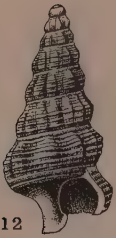
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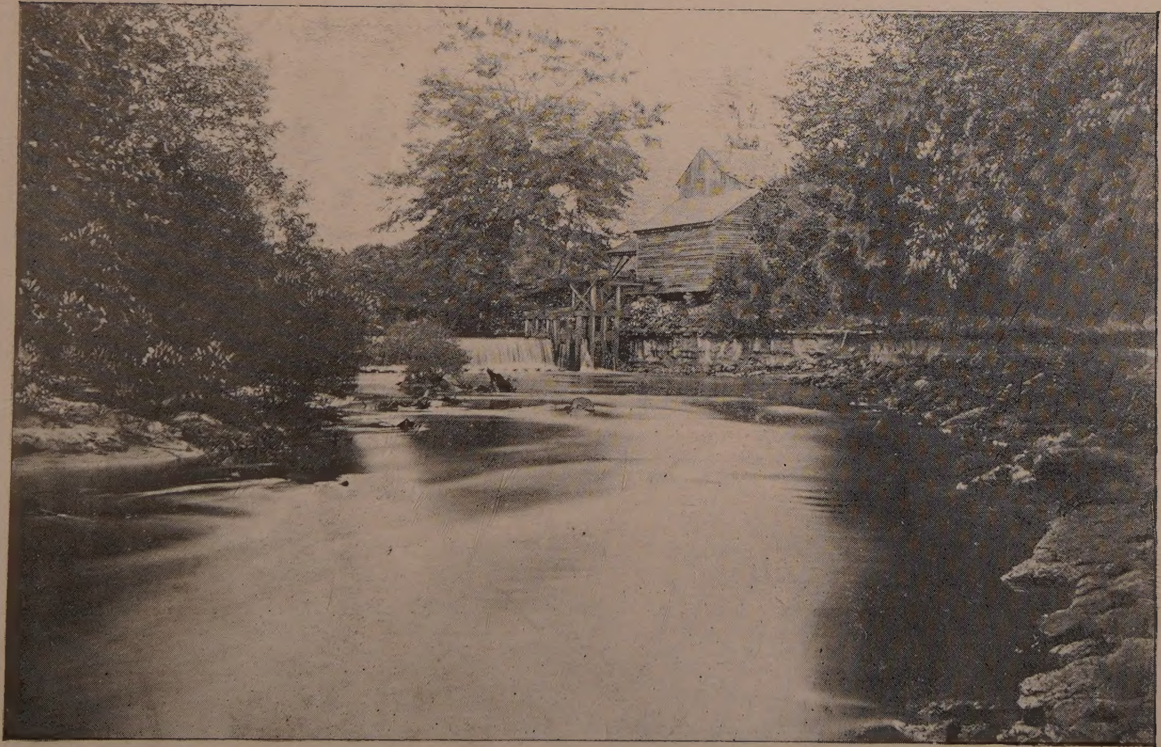

PLATE I.— MIDWAY BEDS EXPOSED AT PALMER'S MILL. *See pp. 31-32.*